

Are unhealthy freshwater ecosystems bad for us?

Is the apocalypse coming asks Dr Death

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¹River Science Massey University & ²Tipu Whenua



Its not easy giving public talks as a river ecologist ☹️

Highest
percentage of
endangered
freshwater fish
species in the
world ☹️

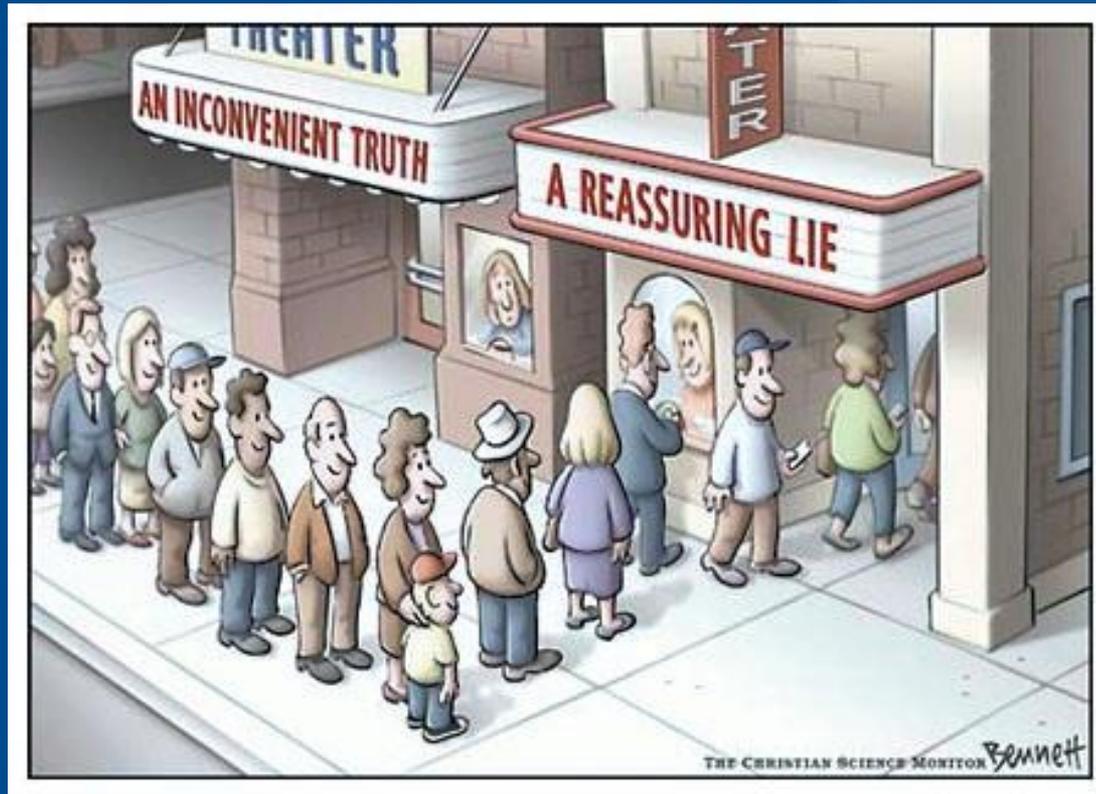
Most polluted
river in the
Western world
☹️

Giving water
(from National
Parks) to bottling
companies to
sell :-)

No monitoring of
any endangered
freshwater
invertebrates ☹️

Increasing
nitrate
levels in our
waterways
☹️

Highest level
of some
waterborne
diseases in
the world ☹️

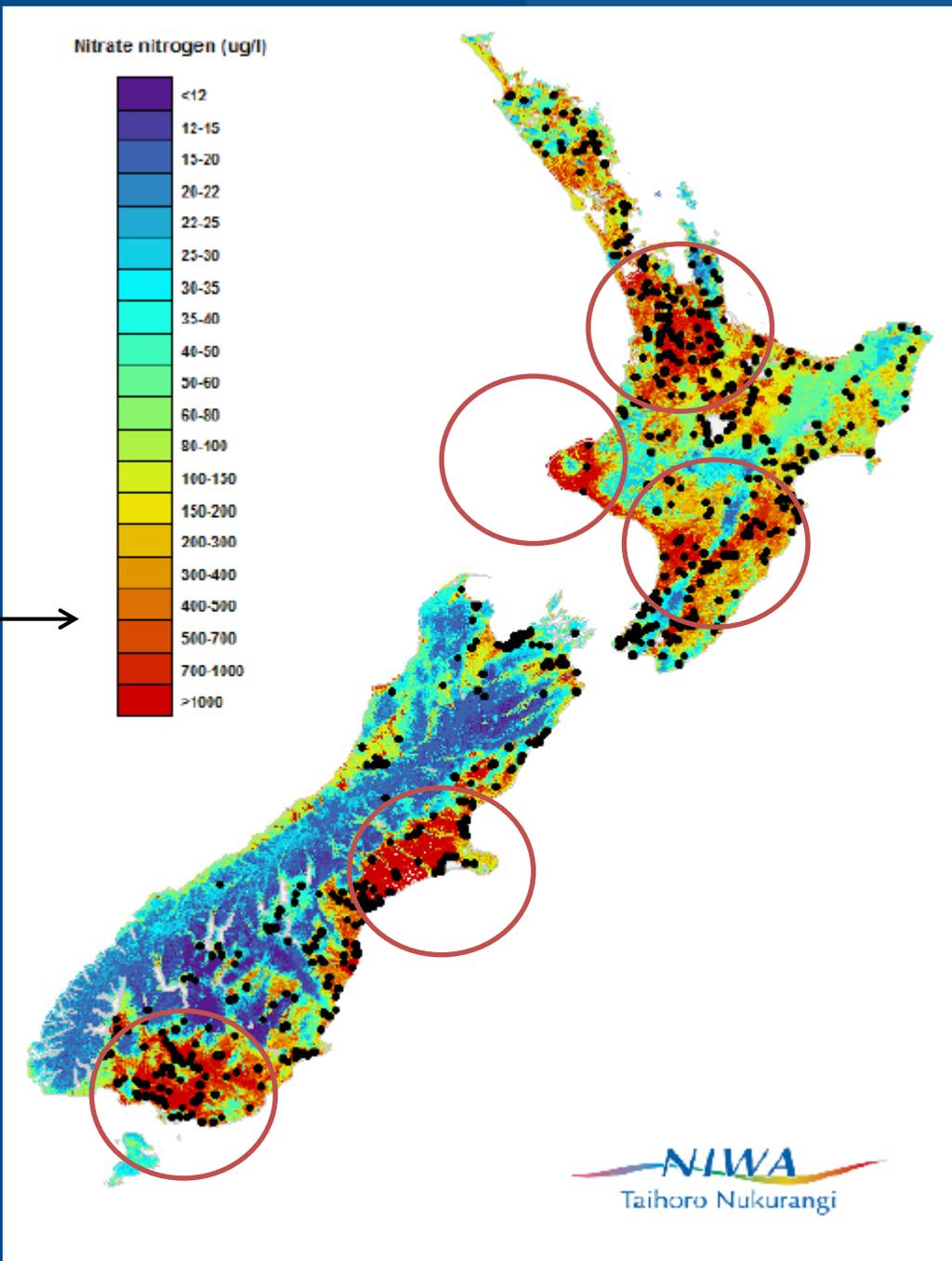




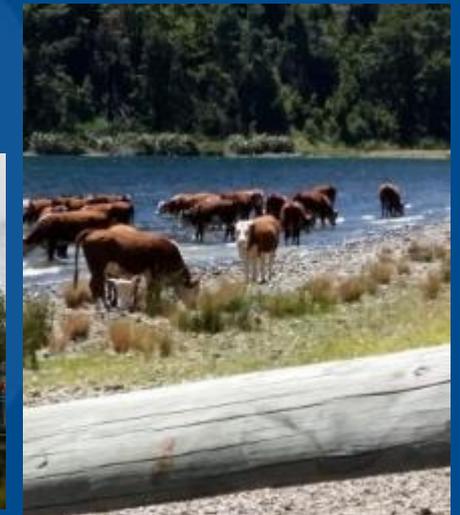
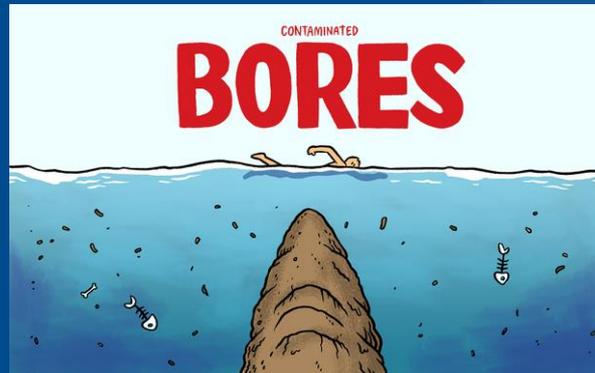


Nitrate

Is water quality declining in New Zealand?
ANZECC trigger level



Unprecedented public concern about our waterways



Three reports this year say – water quality is “declining”



Not to mention 20+ years of science research

Ecologia
© 2007 b

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J. N. Am. Benthol. Soc., 2009, 28(1):220-232
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DOI: 10.1899/07-148.1
Published online 23 December 2009

The influence and

Alexander E
Institute of

Abstract. Demand for water from streams for protecting the ecological few experimental studies reduced discharge by 8 channels/pipes and qu during a 2-mo period of drift distance in control measured the head caps to influence drift distance reduction, but drift return of some taxa was elevated-flow condition concluded that some to the drift or increased d that, in turn, initiated individual can travel in for rapid escape of unf

Key words: macroin aquatic invertebrates.

Water use has risen exponentially with population growth in the last Jackson et al. 2001). Appropriate surface water for human use aquatic biota. The ecological water from aquatic environment interest to water management public, but few experimental studies on the impacts of flow reduction (Dewson et al. 2007a). Most observational surveys that are drought (e.g., Cowx et al.) compared reaches above and below

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J. N. Am. Benthol. Soc., 2007, 26(4):754-766
© 2007 by The North American Benthologists
DOI: 10.1899/07-0038.1
Published online 16 October 2007

Invertebrate discharge

Zoë S. Dewson
Institute of

Abstract. Water abstraction suitability of habitat for invertebrate community manipulations to imitate >85% in 3 small New Zealand moderately polluted, each stream before and the diversions in operation of flow reduction. Flow velocity and depth also and temperature were Ephemeroptera, Plecoptera taxonomic richness decreased invertebrate community changed in response to flow composition involved changes in the physical Our results indicate that streams that vary in water changes in the physical

Key words: water abstraction

Understanding of the impact stream ecosystems is crucial to because global demand for water likelihood of modification of climate change are increasing. Urbanization of the human population expanding area of irrigation many factors leading to increased usage (Postel 1997, Amell 1999) climate-change scenarios predicted in the expected direction and precipitation (Amell and Reynard al. 2004). In any case, the global water is expected to change further affecting the balance between

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Freshwater Biology (2007)

APPLIED ISS

Invertebrate in small

ZOË S. DEWSON
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Introduction

There has been a over the last century and a corresponding (Jackson et al., 2001) ing to predicted a

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Hydrology and Earth System Sciences
Open Access
EGU

River water quality changes in New Zealand over 26 years: response to land use intensity

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Abstract. Relationships between land use and water quality are complex with interdependencies, feedbacks, and legacy effects. Most river water quality studies have assessed catchment land use as areal coverage, but here, we hypothesize and test whether land use intensity – the inputs (fertilizer, livestock) and activities (vegetation removal) of land use – is a better predictor of environmental impact. We use New Zealand (NZ) as a case study because it has had one of the highest rates of agricultural land intensification globally over recent decades. We interpreted water quality state and trends for the 26 years from 1989 to 2014 in the National Rivers Water Quality Network (NRWQN) – consisting of 77 sites on 35 mostly large river systems. To characterize land use intensity, we analyzed spatial and temporal changes in livestock density and land disturbance (i.e., bare soil resulting from vegetation loss by either grazing or forest harvesting) at the catchment scale, as well as fertilizer inputs at the national scale. Using simple multivariate statistical analyses across the 77 catchments, we found that median visual water clarity was best predicted inversely by areal coverage of intensively managed pastures. The primary predictor for all four nutrient variables (TN, NO_x, TP, DRP), however, was cattle density, with plantation forest coverage as the secondary predictor variable. While land disturbance was not itself a strong predictor of water quality, it did help explain outliers of land use–water quality relationships. From 1990 to 2014, visual clarity significantly improved in 35 out of 77 (34/77) catchments, which we attribute mainly to increased

dairy cattle exclusion from rivers (despite dairy expansion) and the considerable decrease in sheep numbers across the NZ landscape, from 58 million sheep in 1990 to 31 million in 2012. Nutrient concentrations increased in many of NZ's rivers with dissolved oxidized nitrogen significantly increasing in 27/77 catchments, which we largely attribute to increased cattle density and legacy nutrients that have built up on intensively managed grasslands and plantation forests since the 1950s and are slowly leaking to the rivers. Despite recent improvements in water quality for some NZ rivers, these legacy nutrients and continued agricultural intensification are expected to pose broad-scale environmental problems for decades to come.

1 Introduction

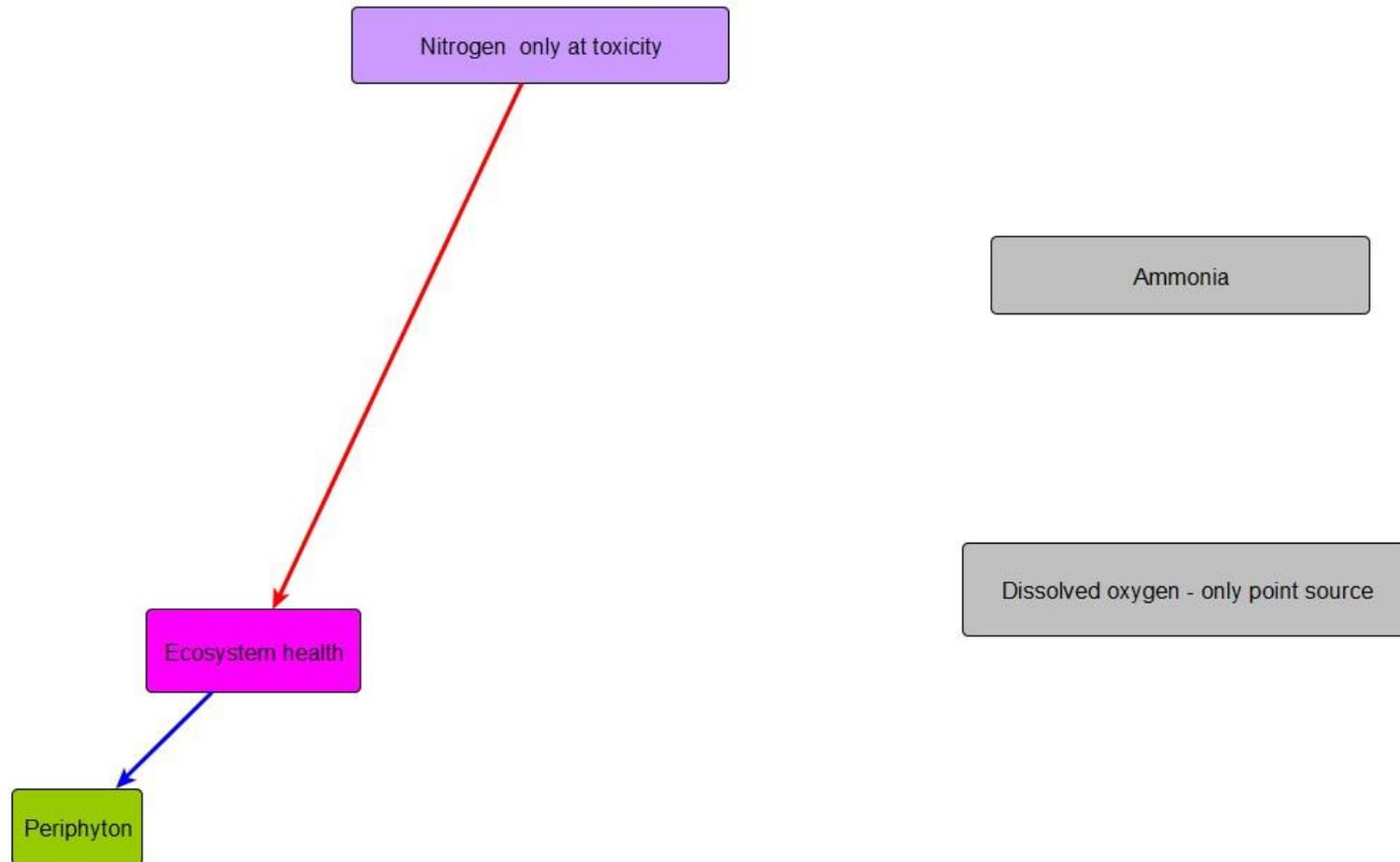
River water quality reflects multiple activities and processes within its catchment, including geomorphic processes, vegetation characteristics, climate, and anthropogenic land uses (Brierley, 2010). Relationships between water quality and these catchment characteristics are not straightforward because all of these factors interact over both space and time. For example, if intensive livestock grazing occurs on steep slopes, surface runoff and consequently river turbidity is expected to be greater than if grazing occurs on flatter areas; in other respects, if fertilizers are heavily applied to sandy soils with high drainage density, rivers will likely become

Clean Water

90% of rivers and
lakes swimmable
by 2040

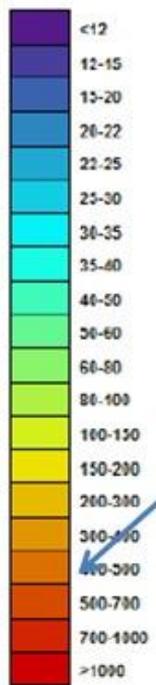
*Just as dirty as
before Water
reforms 2017*



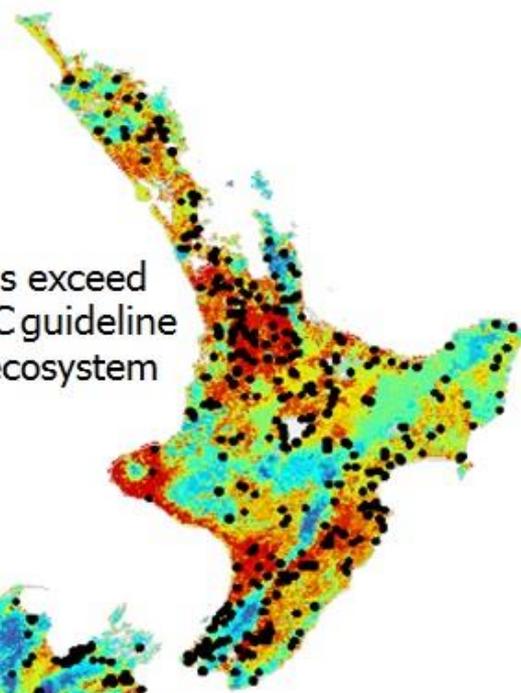


"A fresh start for freshwater" NPS objectives 2014: (making the problem disappear)

Nitrate nitrogen (ug/l)



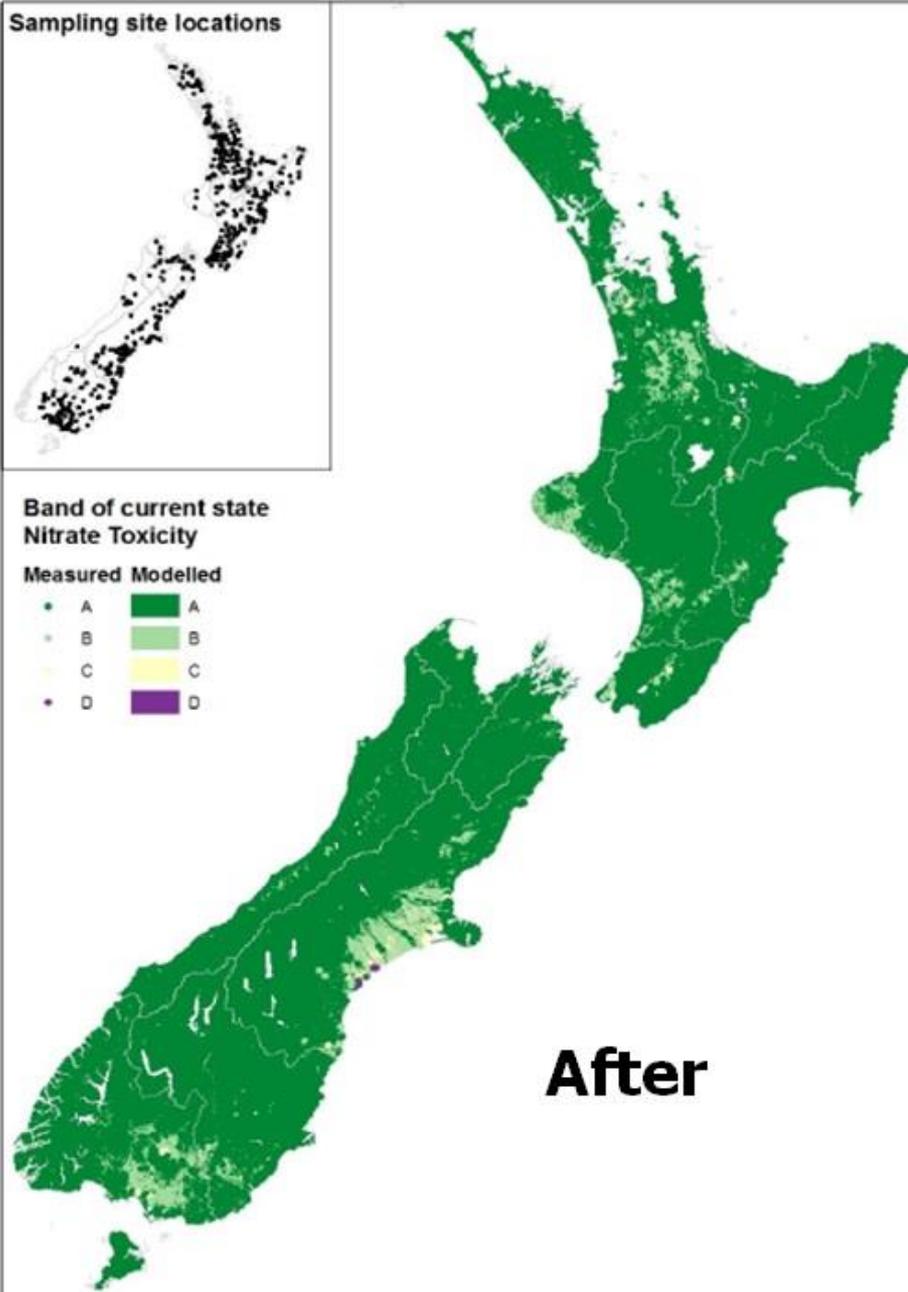
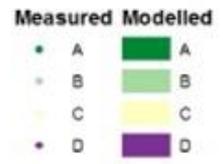
All red areas exceed the ANZECC guideline to protect ecosystem health



Before



Band of current state Nitrate Toxicity



After

Why is water quality bad?

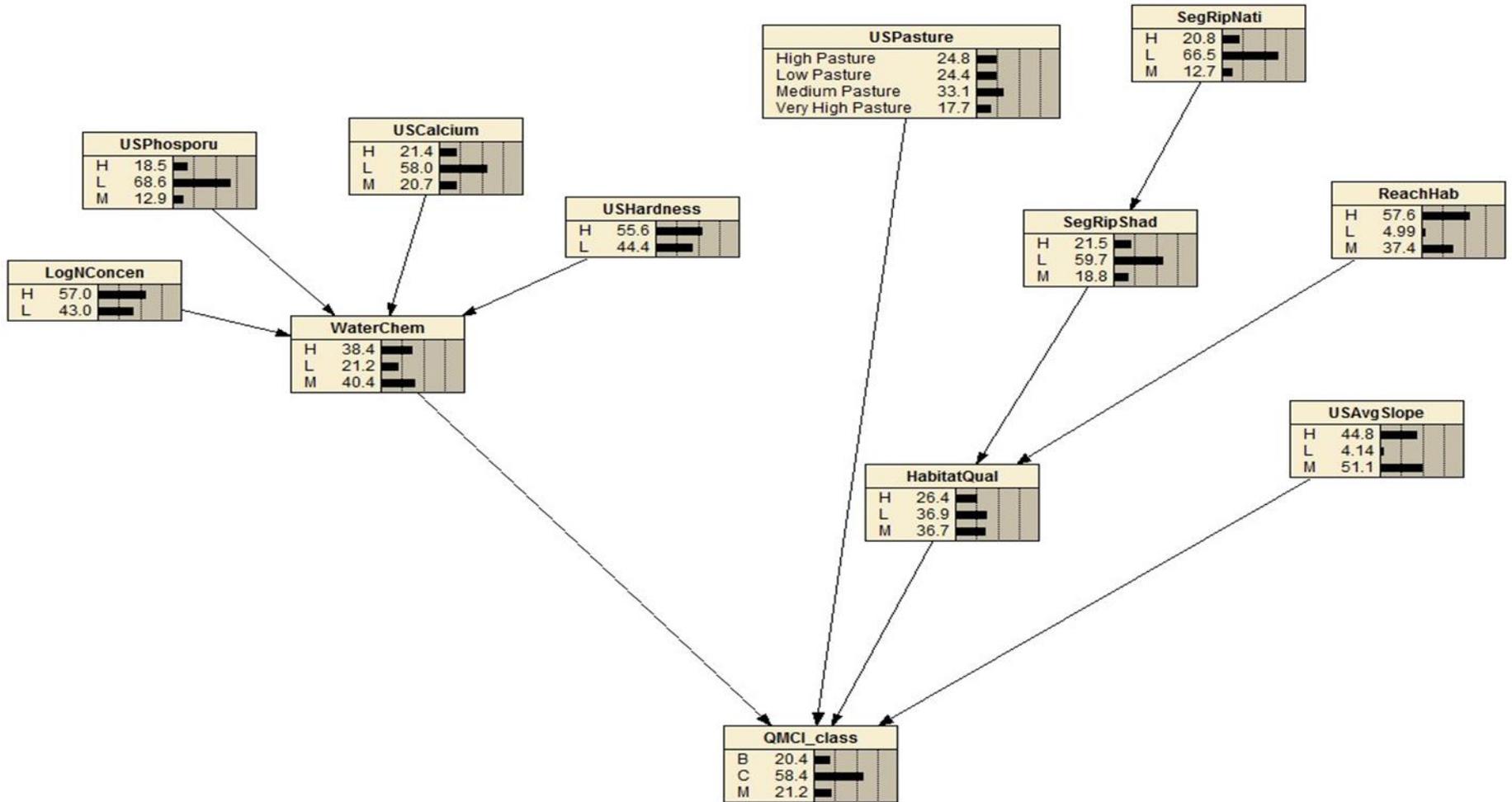


1 dairy cow = 14 humans in faecal waste terms*. There are 6.5 million dairy cows nationally = 90 million humans worth of poo!

*[Environment Waikato 2008]



Ecology Decision Support Tools





Paparangi

Manawatu-Wanganui

Parikino

Mangamahu

Kaiwhaiki

Brunswick

Kai Iwi

Upokongaro

Westmere

Whanganui
Whanganui

Okoia

Kaitoke

Fordell

Whanganui

Image © 2017, DigitalGlobe
Image © 2017, CNES / Airbus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

11.3 km

Google Earth

Poor health in New Zealand rivers?

Ecological health



Human health



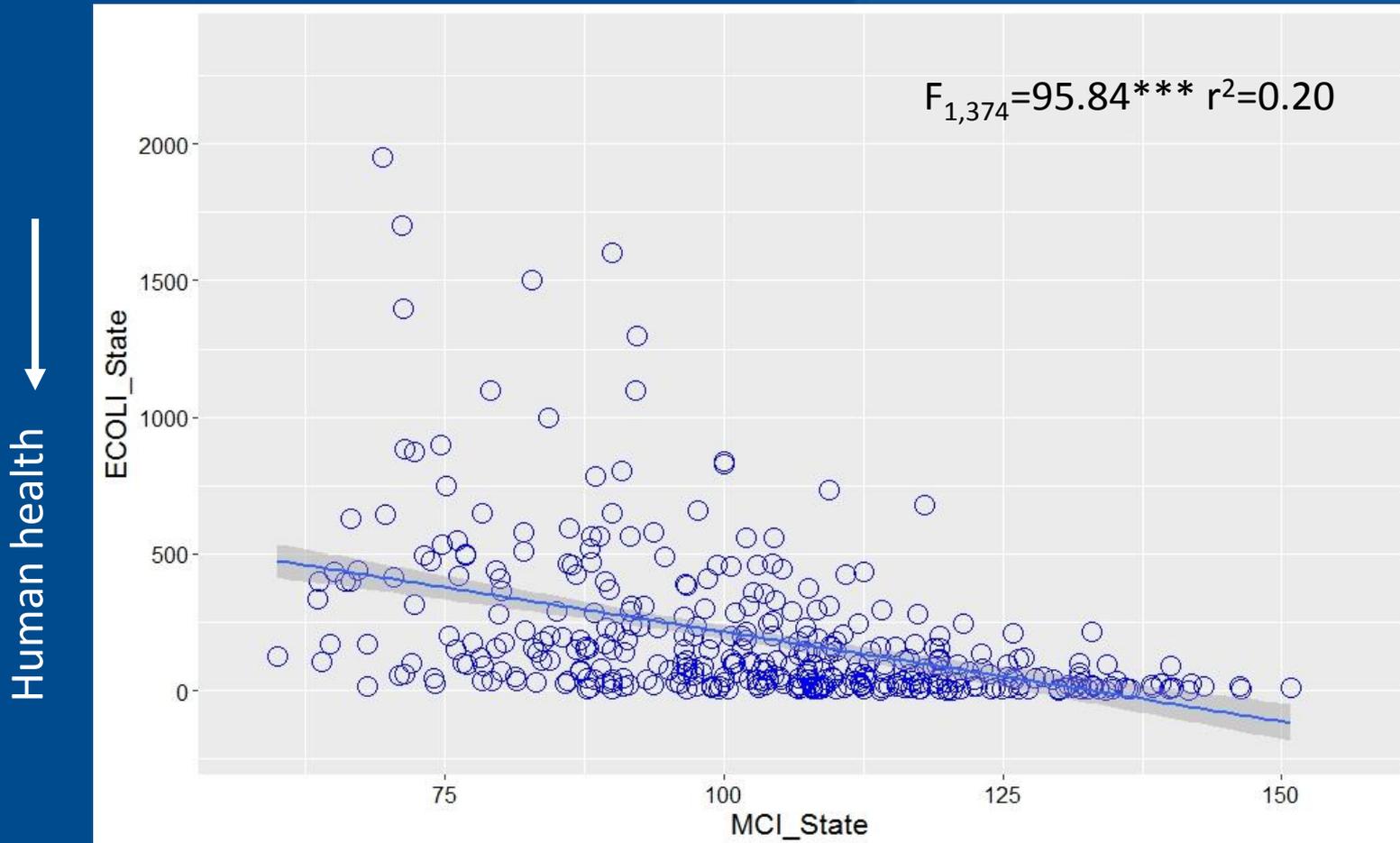
Cryptosporidium
Giardia lamblia
Toxoplasma
Cyclospora
Entamoeba

Hepatitis
Adenoviruses
Non-Group A
Rotaviruses
Caliciviruses

Vibrio (cholerae, vulnificus)
Escherichia coli
Faecal coliform
Shigella
Helicobacter pylori
Leptospira
Campylobacter
Yersinia enterocolitica
Salmonella (typhoid,
paratyphoid)
Clostridium
Mycobacterium
Legionella



Does ecological health = human health?





SICK OF TOO MANY COWS

How intensive livestock farming
could be endangering our health

GREENT

In New Zealand, infections from zoonoses “are among the highest reported for any developed country ... and are a major public health concern” [16].

“Reported cases of cryptosporidiosis are higher in New Zealand than in Australia, the UK, Germany and the USA [17].

The same is true for Shiga toxin-producing *E. coli* (a group of *E. coli* bacteria that cause infection in humans, also known as verocytotoxigenic *E. coli*) [18] and giardiasis [3].

Agricultural industry solution



DairyNZ

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BUSINESS
ENVIRONMENT
FEED
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DAIRY FARMERS SPEND OVER \$1 BILLION ON THE ENVIRONMENT

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Federated Farmers and DairyNZ have conducted a survey on New Zealand dairy farmers' environmental investments, revealing an estimated spend of over \$1billion over the past five years.

Five percent of the nation's dairy farmers responded to the survey and reported on the environmental initiatives they had invested in such as effluent management, stock exclusion, riparian planting, upgrading systems and investing in technology, retiring land and developing wetlands.

ENVIRONMENTAL SPEND BY DAIRY FARMERS
\$1 BILLION OVER 5 YEARS



Solution = One Health



nature
COMMUNICATIONS

ARTICLE

DOI: [10.1038/s41467-017-00775-2](https://doi.org/10.1038/s41467-017-00775-2) OPEN

Upstream watershed condition predicts rural children's health across 35 developing countries

Diego Herrera^{1,2,9}, Alicia Ellis³, Brendan Fisher^{1,2}, Christopher D. Golden⁴, Kiersten Johnson⁵, Mark Mulligan⁶, Alexander Pfaff⁷, Timothy Treuer⁸ & Taylor H. Ricketts^{1,2}

Diarrheal disease (DD) due to contaminated water is a major cause of child mortality globally. Forests and wetlands can provide ecosystem services that help maintain water quality. To understand the connections between land cover and childhood DD, we compiled a

- Do ecologists and microbiologists work together in a catchment management framework?
- Even the regulatory framework seems disjointed
- It also seems the solution framework is disjointed



Are unhealthy rivers bad for?

YES



Its also our economic edge?
Doesn't it make financial sense to have
healthy rivers?

